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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,028	10/11/2006	Charles Simon James Pickles	285545US2X PCT	9920

22850 7590 06/09/2010

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EXAMINER	
DIETERLE, JENNIFER M	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
06/09/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/567,028	PICKLES ET AL.	
	Examiner	Art Unit	
	Jennifer Dieterle	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 May 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 February 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-15 are pending.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/4/10 has been entered.

Response to Amendment

2. Applicant's amendment of 5/4/2010 does not render the application allowable over Shiomi et al., however, the amendment does overcome the rejection utilizing Yamazaki now that a contact surface on a back side of the electrically conducting diamond layer for connection has been provided.

3. Applicant's submission of an affidavit is acknowledged. The affidavit provides a statement by the inventor of the present application that the etching process of the prior art, Shiomi et al., would not leave areas of non-conducting diamond as projections in

the openings or would leave areas of conducting diamond, but these areas would be below the nonconducting layer.

It is noted that the affidavit does not provide any factual evidence or data based on concrete scientific evidence that the etching utilized in Shiomi et al. would lead to the tips of the protuberances 122 of Shiomi et al. to be non-conducting. As shown in the figures of Shiomi et al. the protuberances formed from conducting layer 12 extend up through non-conducting layer 13. Additionally, it has been noted that Shiomi et al. teach that conduction electron emitting protuberances 122 are conducting diamond:

- Col. 5, lines 39-40,
- Col. 6, lines 37-45,
- Col. 12, lines 57-65.

Applicant's attention is specifically directed to Shiomi et al. col. 12, lines 57-65 which states that the conducting diamond portion includes a plurality of electron emitting protuberances **upon which no first (un-doped) diamond layer is disposed.** Based on the actual teaching of Shiomi et al. in col. 6, lines 57-65, applicant's interpretation of the top portion of the pins is non-conducting is incorrect and Shiomi et al. does teach projecting conducting pins 122.

It is also noted that there are etching process in which residual particles can be left behind forming "rabbit ears" which are residual deposits left from an etching process as seen in Komada et al. (US 6,599,841 B2) figure 7F.

While an affidavit or declaration which states only conclusions may have some probative value, such an affidavit or declaration may have little weight when considered

in light of all the evidence of record in the application. In re Brandstadter, 484 F.2d 1395, 179 USPQ 286 (CCPA 1973); MPEP 716.01c. Additionally, declarations in which conclusions are set forth without establishing a nexus between those conclusions and the supporting evidence, or which merely express opinions, may be of limited probative value with regard to rebutting a prima facie case. In re Grunwell, 609 F.2d 486, 203 USPQ 1055 (CCPA 1979); In re Buchner, 929 F.2d 660, 18 USPQ2d 1331 (Fed. Cir. 1991).

Therefore, given the factual evidence of record provided above and in the final office action dated 11/4/09 concerning Shiomi et al., the opinion provided in the affidavit can be afforded only probative value, but does not establish that Shiomi et al. does not produce conducting peaks extending through a nonconducting layer as noted above.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 3, 8, 9, 10, 11, 12 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Shiomi et al. (U.S. Pat. No. 5,844,252).

Regarding claims 1, 3, 11, 12 and 15, Shiomi et al. (in figures 2A-2F and figure 6 and col.6, lines 37-41; col. 7, lines 13-15), teach an apparatus comprising: a nonconducting undoped polycrystalline diamond layer (see figure 2D, 13) in electrical

connection with an electrically-conducting boron-doped polycrystalline diamond projections (e.g., diamond layer figure 2D, 12 and etched electron emission portions 122 that comprise a number or protruberances and recesses; the top of these conducting projections do not contain un-doped diamond see col. 12, lines 57-65) extending at least partially through the layer of nonconducting diamond (figure 2D, 13). Shiomi et al. teach, in figure 6, that the device is connected to an electric circuit. The device has an electric current meter 414 on the doped diamond 410 and a base electrode 406 located on the substrate 408 (col. 8, lines 17-30) thus providing a contact surface which *can be* connected to an external circuit.

Regarding claim 8, Shiomi et al. (in figure 6, col. 8, lines 25-17-32) teach patterned aluminum layers (figure 6, 404) that function as gate electrodes placed on the nonconducting diamond layer (figure 6, 411) which is a surface through which the conducting diamond layer (figure 6, 410) is connected. The circuit comprises current meters (figure 6, 414 and 416) which are an external circuit. Shiomi et al. also teach that the areas of conducting diamond are internally connected within the diamond layer by an electrode (figure 6, 402).

Regarding claim 9, application's specification at 0014 states that, "the contact surface of the diamond could be coated with one or more layers of conductive material, optionally in combination with one or more non-conductive layers, to provide `on board` interconnection." Shiomi et al. (in figure 6, col. 8, lines 25-27) teach that there are gate

electrodes or aluminum layers (figure 6, 404), which are conductive, in contact with a nonconductive layer (figure 6, 411) which would provide the interconnection of the electrically conducing diamond layer.

Regarding claim 10, Shiomi et al. (in figure 6, col. 8, lines 23-28) has gate electrodes or aluminum, metal, layers through which anode (figure 6, 402) is connected. An electric field that the substrate is exposed to in certain embodiments may be created by any suitable technique, for example, by electrodes that are externally connected to the substrate, through metal portions of the substrate. Therefore, areas of the electrically conducting diamond are externally electrically connected into an electrode. Additionally, Shiomi et al. teach a cathode (figure 6, 406) is connected to the substrate (figure 6, 408) and the cathode would be externally connected to the conducting diamond layer because it is first connected to the substrate and not directly connected to the conducting diamond.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 2, 4, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiomi et al. (U.S. Pat. No. 5,844,252) as applied to claim 1 above, and further in view of Yamazaki (U.S. Pat. No. 5,089,802).

Regarding claim 2, Shiomi et al. teach a device having projections that extend to the surface of the layer of nonconducting diamond presenting areas of electrically conducting diamond, however, Shiomi et al. does not teach that the conducting layer is completely coplanar with the nonconducting layer.

Yamazaki teach a device (in figure 1C, col. 2, lines 64-68; col. 3, lines 4-7) comprising a nonconducting undoped polycrystalline diamond layer (figure 1C, 2, col. 4, lines 54-55) in electrical connection with coplanar electrically-conducting boron-doped polycrystalline diamond projections (figure 1C, 10-1, 10-2) extending at least partially through the layer of nonconducting diamond that can be connected to an external circuit. Yamazaki teaches that the device can be used in an integrated circuit for conduction (col. 6) and that the conducting and nonconducting layers can be coplanar (see figure 1B).

Therefore, it would have been obvious to one skilled in the art to modify the pins or projections of conducting diamond in the device of Shiomi et al. to be coplanar with the nonconducting diamond as taught by Yamazaki because the conducting diamond will still perform and have excellent electron emitting characteristics with or without increased surface area of a pin or projection shape.

Regarding claim 4, Shiomi et al. teach a device that has circular areas of electrically conducting diamond. As evidenced by figure 2D, the projections or protuberances can be cones or cylinders (col. 5, line 27). Applicant's specification at section 0009 describes the pins as having a round profile on the analysis surface. No other description is provided, therefore, a cone or cylinder does have a "round" profile. "Round" can mean a circle. When looking down upon a cylinder, it has a "round" or circular top. Additionally, a cone also has a point or a top. While a cone's top is smaller than its bottom, its top is circular in shape or "round." Additionally, if one were to cut

across a cone or cylinder at any point, a circular shape would be achieved that would be in contact with the substance to be measured. Therefore, both a cone and cylinder shape have circular or "round" shapes and can be coplanar with the nonconductive surface as evidenced in claim 2 above.

Regarding claims 13 and 14, Shiomi et al. teach a device comprising a conducting diamond film layer in which the conducting diamond layer form pins or projections extending through a layer of nonconducting diamond forming well shaped recessions having rough edges of conducting diamond film.

Shiomi et al. does not teach a device with smooth edges on the conducting diamond film channel/well layer.

Yamazaki teaches that the areas of electrically conducting diamond and co-planer surface are smooth (figure 1B). If the surfaces are smooth, they are not rough and therefore would have a surface roughness of less than 100nmRa.

Therefore, it would have been obvious to one skilled in the art to modify the surface of the conducting diamond to be smooth as taught by Yamazaki because a smooth diamond layer would provide a uniform thickness and a shape which can be uniformly filled with a know amount of additive.

6. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being obvious over Shiomi et al. (U.S. Pat. No. 5,844,252) and Yamazaki (U.S. Pat. No. 5,089,802), as applied to claims 3 above, in view of Malinski et al. (U.S. Pat. No. 5,603,820).

Regarding claims 5 and 6, Shiomi et al. teach a device having a conductive and nonconductive diamond layer with wells, however, it does not teach that the wells contain an additive that modifies the sensitivity or selectivity of the device.

Malinski et al. teach an electrode sensor that has a coating of the gas-permeable membrane as previously, such as Nafion, that may be applied onto the electrode by any suitable means (col. 9, line 5). The membrane modifies the sensitivity or selectivity of the electrode because now a specific gas will bind or interact with the membrane (col. 9, lines 15-21).

Therefore, it would have been obvious to one skilled in the art to modify the wells of Shiomi et al. by covering them with using a membrane which would be coplanar with the nonconductive surface as taught by Malinski because a membrane will change the selectivity of the electrode behavior in that it will increase selectivity or specificity for a certain gas or analyte thus promoting detection and efficiency of the device.

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being obvious over Shiomi et al. and Malinski et al. (U.S. Pat. No. 5,603,820), as applied to claims 5 or 6, in view of Buttery et al. (U.S. Pat. No. 5,405,618).

Regarding claim 7, Shiomi et al., in view of Malinski et al., teach a device which have a membrane that modifies the sensitivity or selectivity of the electrode, but does not teach that the membrane has an electrochemical (bio-)chemical.

Buttery et al. teach a biomosaic polymer which has biologically active material bound at its surfaces. The biomosaic polymers may be formed into membranes, films,

beads, or other structures for a variety of assays. The polymer may be a porous membrane, and the biologically active material may be useful for biospecific reactions such as immunoassays, bioseparations, enzyme-catalyzed reactions and the like (abstract and field of invention).

Therefore, it would have been obvious to one skilled in the art to modify the polymer layer of Shiomi et al. to contain a biochemical as taught by Buttery et al. because a biochemical additive would allow for the selectivity of particular material such as antigen in a biological sample.

Response to Arguments

Applicant's arguments filed 5/4/2010 have been fully considered but they are not persuasive.

8. As noted above, applicant's response that Shiomi et all. fails to teach pins or projections of electrically conducting diamond extending at least partially through the layer of non-conducting diamond is acknowledged, but is not persuasive. Shiomi et al. does teach electrically conducting projections 122 present through the layer of non-conducting diamond 13 (figure 2D). Applicant's interpret Shiomi et al. figure 2D as having "non-conducting tips" (i.e. layer 13) on top of the conducting pins 122. This interpretation is inconsistent with the teaching of Shiomi et al. Applicant is directed to the following location in Shiomi et al. which teach that conduction electron emitting protuberances 122 (i.e. conducting diamond):

- Col. 5, lines 39-40,

- Col. 6, lines 37-45,
- Col. 12, lines 57-65.

Applicant's attention is specifically directed to col. 12, lines 57-65 which states that the conducting diamond portion includes a plurality of electron emitting protuberances **upon which no first (un-doped) diamond layer is disposed.** Based on the actual teaching of Shiomi et al. in col. 6, lines 57-65, applicant's interpretation of the top portion of the pins is non-conducting is incorrect and Shiomi et al. does teach projecting conducting pins 122.

9. Additionally, it is again noted that although applicant remarks that Shiomi et al. teach a field emitting device and does not teach a microelectrode and that the device of Shiomi et al. cannot function as a microelectrode, the microelectrode is the intended use of the device. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See In re Casey, 152 USPQ 235 (CCPA 1967) and In re Otto, 136 USPQ 458,459 (CCPA 1963). Additionally, it is well known that a microelectrode is an electrode (i.e. an electrical conductor) with tip dimensions small less than 1m. Shiomi et al. teach the use of diamond which has excellent electron emitting characteristics and is a widely recognized material for achieving improved voltage and thermal properties (col. 1, lines 29-35). Additionally, Shiomi et al. teach that the protuberance has a diameter of 1 micrometer and a height of 5 micrometers which falls within the range of less than 1m.

Therefore, the device of Shiomi et al. is on the micro level and made of diamond and is capable of conducting.

Conclusion

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tessmer et al. teach that two or more layers of various doped or undoped (col. 5, lines 28-31) diamond films can be deposited on a substrate to form a diamond multi-layer structure in which the diamond can be natural, synthetic, or can be polycrystalline diamond (e.g., grown by a CVD technique)(col. 3, lines 39-42). Tessmer et al. teach a process of etching, using a conventional diamond etching technique, to form a mesa structure (col. 5, lines 34-35). The mesa structure is a channel/well structure in which some layers are higher than others (see figures 2B-E). Etching is performed using ECR, electron beam assisted plasma etching (EBAPE), oxidation, or some other diamond etching technique until the desired mesa height is reached making

a substantially smooth diamond layer having a predetermined thickness on a substrate (col. 5, lines 38-41).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer Dieterle whose telephone number is (571) 270-7872. The examiner can normally be reached on Monday thru Friday, 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMD
5/25/10

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795